

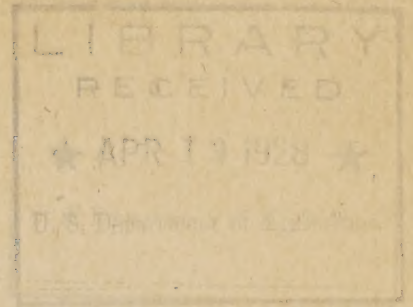
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February 1, 1923.

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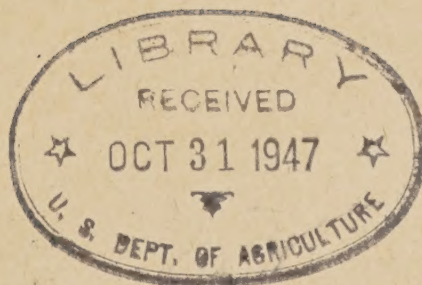
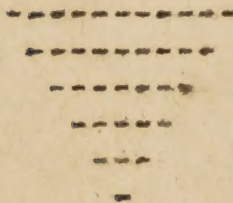
PROGRAM - AND - PLAN

OF

EUROPEAN CORN-BORER

INVESTIGATIONS

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PROGRAM AND PLAN OF EUROPEAN CORN-BORER

INVESTIGATIONS - 1923 #

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- Supercedes and supplements "Program" of 1919, 1920 and 1921.

THE HISTORY OF THE
UNITED STATES OF AMERICA
FROM 1789 TO 1861

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THE HISTORY OF THE UNITED STATES OF AMERICA FROM 1789 TO 1861

February 1, 1923.

I - DISTRIBUTION.

Assignment - Messrs. Worthley, W. O. Ellis and assistants.

A - Determination of the actual distribution of P. nubilalis in the U. S. along the lines followed during former years.

1 - One man at each of the laboratories (Arlington, Silver Creek, N. Y. and Sandusky, O.) to determine material sent in by field scouts and quarantine inspectors. Adults to be reared to confirm larval determination when necessary-especially if P. nubilalis is sent in from areas widely separated from present areas of infestation, or from new and important economic host plants.

II - CONTROL.

Assignment-Messrs. Worthley, Caffrey, Barber, Hodgson and assistants.

A - Burning infested material-Mr. Worthley (as in 1921-1922 "Program")

B - Steaming " " " " " " " " " "

C - Crushing " " - do do

D - Burying " " - in manure or compost- do

E - Plowing under or burying infested material.

1 - General field observations to determine the effectiveness of clean fall or spring plowing under of infested material under farm conditions. This includes a continuation of the cooperative work on Perkins farm (Winchester) and Bladwin farm (Weburn), as well as the cooperative project with Port Stanley, Ont. and Silver Creek, N. Y. laboratories. Also see III-B-1-a.

F - Feeding infested material to livestock (as in 1921-1922 "Program")

G - Weed killing substances-Mr. Worthley do

H - Time of planting-Mr. Hodgson.

1 - Detailed observations on date of planting, per cent of infestation and date of harvest on three or more market garden farms where a series of sweet corn plantings are made. General observations-as far as time will permit-on additional farms with the object of ascertaining the possibility of escaping maximum damage by regulating planting date. Keep in mind the following points.

a - Time of planting.

b - Date of harvest (or duration of period necessary for maturity)

c - Possibility of selecting certain varieties that will reach the "roasting ear" stage between generations even though planted relatively early.

d - Relative infestation in stalks and ears.

e - Commercial results secured from regulating time of planting.

(1) - Will ears be ready for market when low or high prices prevail?

(2) - Will the variety selected be popular with the trade?

(3) - Can this plan be used by farmers growing corn for canning?

(Also see "Plan of Expt. Plots").

2 - Make observations on the possibility (apparently remote) of planting early maturing flint corn (field) early enough so the ears will become mature before the second generation larvae become full grown. (Also see "Plan of Expt. Plots").

I - Selection of varieties (See "Plan of Expt. Plots").

I - DISCUSSION TOPIC

Assignment - Research, Analysis, Synthesis, Evaluation, and Communication.
A - Investigation of the nature and extent of the problem.
B - One can at each of the following stages (Analysis, Synthesis, Evaluation, and Communication) be in one of three states: (1) no knowledge, (2) partial knowledge, (3) complete knowledge.
C - The investigation is a process of discovery and learning.
D - The investigation is a process of discovery and learning.
E - The investigation is a process of discovery and learning.
F - The investigation is a process of discovery and learning.
G - The investigation is a process of discovery and learning.
H - The investigation is a process of discovery and learning.
I - The investigation is a process of discovery and learning.

II - CONCLUSIONS

Assignment - Research, Analysis, Synthesis, Evaluation, and Communication.
A - The investigation is a process of discovery and learning.
B - The investigation is a process of discovery and learning.
C - The investigation is a process of discovery and learning.
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J - The investigation is a process of discovery and learning.
K - The investigation is a process of discovery and learning.
L - The investigation is a process of discovery and learning.
M - The investigation is a process of discovery and learning.
N - The investigation is a process of discovery and learning.
O - The investigation is a process of discovery and learning.
P - The investigation is a process of discovery and learning.
Q - The investigation is a process of discovery and learning.
R - The investigation is a process of discovery and learning.
S - The investigation is a process of discovery and learning.
T - The investigation is a process of discovery and learning.
U - The investigation is a process of discovery and learning.
V - The investigation is a process of discovery and learning.
W - The investigation is a process of discovery and learning.
X - The investigation is a process of discovery and learning.
Y - The investigation is a process of discovery and learning.
Z - The investigation is a process of discovery and learning.

February 1, 1923.

1 - General observations and field counts on farms to determine possible relative immunity of varieties or types of field or sweet corn. (Judging from results to date this possibility seems remote except as correlated with time of planting).

J - Trap crops (as in 1921-1922 "Program").

1 - Ascertain effectiveness of using early planted European millet as a trap crop. (This method recommended by Russian entomologists). (Also see "Plan of Expt. Plots")

K - Cutting corn stalks, or stubble, level with soil and its immediate utilization by feeding, crushing or otherwise (as in 1921-1922 "Program").

L - Application of poison sprays, dusts or contact insecticides - Mr. Worthley (as in 1921-1922 "Program")

1 - A thorough canvas of all insecticides and their possible adaptation to protecting plants from severe P. nubilalis damage. Slight encouragement secured during 1922 when Sulphur-Lead-Lime (80-10-10) applied as a dust to dent field corn gave decided protection from first generation as compared to check plot. An effective method for restricting first generation damage might be adapted to the one generation area.

2 - Possible methods of hand treatment of valuable plants such as dahlias and greenhouse chrysanthemums.

M - Sterilization of infested plant products- Mr. Barber.

1 - Heating.

a - Corn on the cob.

(1)- A study of the rise of temperature within the ear of corn.

(a) - Flint. (b) - Dent. (c) - Sweet. (d) - Pop.

(2)- Determine killing point of free larvae.

(3)- From data secured under (1) and (2) proceed to the actual heating of infested ears of corn to determine a safe recommendation relative to period of heating and temperature necessary to insure death of all larvae contained therein; with due regard for germination of corn used for seed.

(a) - Ears in bulk (In a bushel basket and in piles on floor of heating chamber.

(aa) - Flint. (bb) - Dent. (cc) - Sweet. (dd) - Pop.

(b) - Ears placed on racks to allow free circulation of heated air among ears.

(aa) - to (dd) same as (a).

(4)- Perfection of apparatus and equipment for these experiments.

(5)- Effect of heating on the germination of the grain and the future development of plants resulting therefrom.

(a) - Effect on germination.

(aa) - "Rag-doll" test.

(b) - Effect on future development.

(aa) - Grain planted in experimental field.

N - Control by spring burning.- Mr. Barber.

1 - Cornstalks piled in the fall and burned at an opportune time (when dry) in the spring, before emergence of adults.

Note: In such piles the majority of the borers migrate to outer layers of stalks in order to escape the excessive moisture prevailing in the interior of the piles. These outer layer of stalks are usually sufficiently dry to burn during late April or early May. Will this method be a cheap and practical way of destroying a sufficiently high per cent of the larvae in a given field?

January 1, 1933.

1 - General observation and field notes on the behavior of the birds in the vicinity of the lake or water body. (The birds were seen to be in the vicinity of the lake or water body.)

2 - The birds were seen in the vicinity of the lake or water body. (The birds were seen to be in the vicinity of the lake or water body.)

3 - The birds were seen in the vicinity of the lake or water body. (The birds were seen to be in the vicinity of the lake or water body.)

4 - Application of poison spray, dust or contact insecticide. (The birds were seen to be in the vicinity of the lake or water body.)

5 - A thorough survey of all insecticides and their possible application to protect the birds. (The birds were seen to be in the vicinity of the lake or water body.)

6 - Possible methods of land treatment of various plants such as dandelions and greenhouses. (The birds were seen to be in the vicinity of the lake or water body.)

7 - Distribution of selected plant products. (The birds were seen to be in the vicinity of the lake or water body.)

8 - The birds were seen in the vicinity of the lake or water body. (The birds were seen to be in the vicinity of the lake or water body.)

9 - The birds were seen in the vicinity of the lake or water body. (The birds were seen to be in the vicinity of the lake or water body.)

10 - The birds were seen in the vicinity of the lake or water body. (The birds were seen to be in the vicinity of the lake or water body.)

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12 - The birds were seen in the vicinity of the lake or water body. (The birds were seen to be in the vicinity of the lake or water body.)

13 - The birds were seen in the vicinity of the lake or water body. (The birds were seen to be in the vicinity of the lake or water body.)

14 - The birds were seen in the vicinity of the lake or water body. (The birds were seen to be in the vicinity of the lake or water body.)

15 - The birds were seen in the vicinity of the lake or water body. (The birds were seen to be in the vicinity of the lake or water body.)

16 - The birds were seen in the vicinity of the lake or water body. (The birds were seen to be in the vicinity of the lake or water body.)

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2 - A study of methods of handling this material to promote complete burning of the stalks containing the larvae.

III - LIFE HISTORY AND HABITS.

Assignment-Messrs. Barber, Babcock, W. O. Ellis, Patch, Scott and assistants.

Note: Most of the observations and projects detailed under this section in the 1921-1922 "Program" have been completed and closed - a report of which will be found in the Proff. Paper soon to be presented for publication. Many of these points will be kept in mind, however, for the purpose of adding to, or correcting information already secured. Additional information is essential on the following items.

A - Egg.

1 - Proportion of eggs dislodged from original position on plant and the effect on hatching.

B - Larva.

1 - Habits.

a - Ability of larvae to reach surface of soil after burial of host, as in plowing under of infested material.

(1) - Field experiments.

(a) - Plowing under stubble in fall.

(aa) - Migration from this material.

(bb) - Examinations at intervals.

(2) - Cage experiments to determine:

(a) - Effect of date of burial (at 6").

(aa) - In wooden box cages 19" x 15" x 12" deep. Top covered with 20 mesh copper wire screen. Recovery trap of corrugated paper strips on inside of cage near top. Eight inch ventilating hole on each end of cage, covered with screen. No bottom to cage. Each cage contains 10 sections of corn stalks with an average of from one to two larvae per section.

1st generation	(aaa)	-	Series buried VII-19-22	(10 cages)
do	(bbb)	-	" " VIII-1-22	do
do	(ccc)	-	" " VIII-15-22	do
do	(ddd)	-	" " IX-1-22	20 cages
2nd generation	(eee)	-	" " IX-15-22	do
do	(fff)	-	" " X-1-22	do
do	(ggg)	-	" " X-15-22	do
do	(hhh)	-	" " XI-1-22	do
do	(iii)	-	" " XI-15-22	do

Note: Contents of cages removed and examined at frequent intervals during fall of 1922 and spring of 1923.

(b) - Effect of type of cage (at 6").

(aa) - Three series of 7 experimental lots each. One lot buried in wooden box cage 48" x 18" x 12" deep with screen top and recovery trap as in (a). Remaining 6 lots buried in adjoining soil at same depth and in same manner, but not subjected to any cage conditions. This reproduces the Canadian type of experimental burial. Each lot consists of 4 corn stalks containing a total of approximately 90 second generation larvae.

(aaa) - Series buried IX-20-22

(bbb) - " " X-5-22

(ccc) - " " X-20-22

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Note: Examinations made as in (a), checking the migration, if any occurs, from each lot by an examination of the recovery trap of the buried lot in the series.

(bb) - Series of 10 cages 24" x 12" x 12" deep with screen top and recovery trap as in (a). The sides of the cages composed of a wooden collar 4" wide at top and with the lower 8" composed of 20 mesh copper wire screen. To ascertain possible influence of wood or screen as sides of burial cages. Each cage contains 10 sections of corn stalks bearing a total of approximately 15 to 20 second generation larvae.

(aaa) - Series buried X-1-22.

Note: Examinations made as in (a).

(cc) - Five series of ten experimental lots each, buried without cages. Each lot contains 10 sections of corn stalks bearing a known total number of second generation larvae (from 42 to 92 per lot)

(aaa) - Series buried X-12-22

(bbb) - " " X-17-22

(ccc) - " " X-22-22

(ddd) - " " X-27-22

(eee) - " " XI-2-22

Note: Examinations made as in (a).

(c) - Effect of type of soil (at 6").

(aa) - Three large wooden cages 36" x 40" x 22" deep filled with beach sand. In each large cage buried one cage of the type described in (a) and also 3 lots of material without a cage. Each lot of material contained 10 sections of corn stalks bearing a total of approximately 14 second generation larvae. Same larval content in small cage.

(aaa) - Buried entire series X-2-22

(bb) - Two cages identical with (aa) filled with gravel. Burials same as (aa).

(aaa) - Buried entire series X-2-22.

(cc) - One cage identical with (aa) filled with clay top soil. Burials same as (aa).

(aaa) - Buried entire series X-2-22.

(dd) - Three cages identical with (aa) filled with muck. Burials same as (aa).

(aaa) Buried entire series X-2-22

Note: Examinations as in (a), checking the migration, if any occurs, from each lot, by an examination of the recovery trap in the small cage contained in each large cage.

(d) - Winter and Spring mortality of buried larvae.

(aa) - Three series of 20 cages each, buried XI-2-22, at 2", 4" and 6" respectively. Cage is 2" x 4" x 1/8" thick and composed of 20 mesh copper wire screen tacked to thin wooden strips. Ten free larvae to each cage.

Note: 1-Examinations as in (a). Note 2- Aside from the checks secured between the different methods of burial, the natural mortality of the larvae will be secured in counts made under "Hibernation" and "Parasites".

b - Migration.

(1) - To other parts of same host.

(2) - To other hosts.

(3) - Distance of migration in each instar.

(4) - Influence of weather on migration.

(5) - Efficiency of natural or artificial barriers in limiting migration: i. e. brooks, marshes, roads, walls, etc.

(5)
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(6) - Daily and seasonal period of greatest migration.

(a) - Fall migration.

{aa} - Time of greatest activity.

{bb} - Date " " "

{cc} - Reason for migration.

{dd} - Objective of "

{ee} - Distance " "

(b) - Spring migration.

{aa} - Migration from heaps of cornstalks.

{aaa} - Distance.

{bbb} - Period of activity.

{bb} - Migration within heaps of cornstalks.

(7) - Cage experiments - W. O. Ellis.

(a) - Beets and corn.

{aa} - Migration of larvae from beets to corn.

{aaa} - Beets transplanted into cage are infested with larvae.

{bbb} - Uninfested corn plants transplanted to cage 5 days following beet infestation.

{bb} - Migration, if any, from infested corn to uninfested beets. Procedure vice-versa above.

{b} - Spinach and corn.

{c} - " " beets.

{d} - Beans " corn.

{e} - Beets " beans.

(8) - Field observations.

(a) - Migration of young larvae from spinach crop.

{aa} - To nearby beets, beans etc.

{bb} - " " young corn.

(b) - Dispersion of larvae hatching from egg-masses on dahlia flowers.

{aa} - Percentage of larvae from single mass which enter bloom.

{bb} - Percentage which enter stalks.

{c} - Migration of larvae to grape vines and fruit.

{d} - Migration of larvae to apples.

{aa} - Wind falls.

{bb} - Apples on the tree.

c - Hibernation.

(1) - In protected locations.

{a} - Telephone poles.

{b} - Buildings or other wooden objects.

{c} - Stone walls and similar locations.

(2) - In unprotected locations.

{a} - Among grass-roots (sod).

(3) - Mortality during hibernation.

{a} - Experimental.

{aa} - The placing of a uniform number of cornstalks, with a known larval content, in representative localities of Mass; N. H. and Maine and covering as wide a range of winter conditions as can be secured.

{bb} - Spring examination of the above to determine mortality.

(b) - Field counts in Spring to determine:

{aa} - Mortality in different host plants

{bb} - " " " localities.

{cc} - " " " plants, in different positions.

February 1, 1923.

(aaa) - Lying on the ground.

(bbb) - Standing.

Note: Counts under (b) will serve as a check on the mortality data secured under (a)

C - Pupa (details adequately determined).

D - Adult.

1 - Habits.

a - Attraction of adults.

(1) - Attraction to baits.

(a) - Fruits, syrups, oils etc.

(b) - Maserated corn plants - in an attempt to isolate the substance which attracts the ovipositing females to corn plants.

(2) - Attraction of lights combined with baits.

E - Seasonal history.

1 - Seasonal development.

a - Field counts showing development of stages.

(1) - Systematic counts

(a) - Arlington, Mass. and vicinity in corn.

(b) - Cambridge, " " " " cocklebur.

(2) - General counts (Different locations and host plants).

(a) - Section of infested territory north of Arlington.

(b) - " " " " south of Arlington.

(c) - " " " " including Cape Cod.

(3) - Occasional counts for gross seasonal development.

(a) - Maine.

(b) - New Hampshire.

(4) - Breeding of overwintering material at Bristol, N. H.

b - Reduction of data (under a) to curves of seasonal development for:

(1) - All localities and all host plants.

(2) - Corn from all localities.

(3) - Cocklebur from all localities.

(4) - All localities north of Arlington.

(5) - " " south " "

(6) - " " on Cape Cod.

(7) - Corn in Arlington and vicinity.

(8) - Cocklebur in Cambridge and "

c - Phenological notes on the development of certain trees and shrubs in an attempt to correlate the advancement of the season with the seasonal development of P. nubilalis stages - especially during the spring and early summer. Very Important. This to be in cooperation with Mr. Hodgson (V-K-4-c)

d - A study of the possible factors contributing to the difference in number of generations in various localities.

(1) - Temperature correlations.

(a) - Constant temperature to the development of all stages.

(aa) - Threshold of development

(bb) - Rates " "

(aaa) - Q_{10} , Q_2 , Q_1

(cc) - Critical points in the developmental range of

temperature.

(aaa) - Death points.

(bbb) - Optimum.

(ccc) - Maximum and minimum rates.

(b) - Effectiveness of constant and variable temperatures upon development.

(aa) - Due to different rates of development.

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- (bb) - Due to stimulation of changes of temperature.
- (c) - Insectary data.
 - (aa) - Accumulated temperatures above/ ^{various} thresholds of development from 45 to 54 Fahr. inclusive.
 - (bb) - General curve for development.
 - (aaa) - Eastern Mass.
 - (bbb) - Western New York.
 - (d) - Phenological data (similar to (c)).
- (2) - Host Plant Associations.
 - (a) - Detailed study of localities where corn borer exists as regards flora. A correlation of limits of existence with type, or type of plants will be attempted together with a study of various ecological conditions under which P. nubilalis is known to exist.
 - (b) - Comparison of data obtained in (a) with the ecological areas in the U. S. and Canada.
- (3) - Comparison of localities in Old and New Worlds.
 - (a) - By means of climographs.
 - (b) - Accumulated temperatures.
- (4) - Laboratory experiments.
 - (a) - Winter precipitation experiment.
 - (aa) - Comparison of various months as to the effectiveness of precipitation and dryness.
 - (bb) - General experiment to determine the ease with which hibernation may be broken up at various times during the period.
 - (aaa) - Collections immediately from the field.
 - (bbb) - Collections dried 3 days; to incubator.
 - (ccc) - Collections dried 3 days, soaked 24 hours; to incubator.
 - (ddd) - Collections dried 3 days, soaked 24 hours, dried 3 days; to incubator.
 - (eee) - Collections dried 3 days, soaked 24 hours, dried 3 days, soaked 24 hours; to incubator.
 - (b) - Spread of emergence in the spring.
 - (aa) - Collection of series of larvae consisting of 25 larvae each to be made every week from three localities and placed in incubator under identical conditions of temperature and humidity. To begin about April 1st.
 - (bb) - An experiment to be conducted during the pre-pupation period in the spring to determine the effect upon pupation of the larva overwintering in the upper and lower portions of the cornstalk, respectively. This has been the result of our pupation frequency studies obtained in previous seasons work on the spread of emergence where we have found the pupation to take place in two or more distinct groups showing the effect of some in delaying certain groups of individuals. Collections will be made of 50 larvae each from the upper and lower portions of the stalks and placed in the incubator under like conditions of temperature and humidity.
 - (c) - Checking of the apparent discrepancies in last season's work. (These points to be determined later).
 - (5) - Field experiments.
 - (a) - Breeding progeny obtained from material used in winter precipitation experiment.
 - (aa) - Season 1921-1922 (Previous treatment continued).
 - (bb) - Season 1922-1923
 - (b) - Phenological field counts.
 - (6) - Study of the possible effects of heredity on the number of generations in certain localities.

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- (a) - Rearing material originally transferred from several different areas to the Mass. area; using large field cages.
 - (aa) - Material from western N. Y.-1920.
 - (bb) - " " " " " " -1922.
 - (cc) - " " " " Auch, France.
 - (dd) - One generation 1920 material from Mass.
- (b) - Cross breeding and rearing of
 - (aa) - Mass. females with N. Y. males.
 - (bb) - " males " " " females.
- (c) - Cross breeding for fertility of eggs.
 - (aa) - Mass. females with French males.
 - (bb) - " males " " " females.
 - (cc) - N. Y. females " " " males.
 - (dd) - " " males " " " females.
- (d) - The perfection of a field cage for the rearing work under (a) to (c).

IV - DISPERSION.

Assignment: Laboratory staff.

A - Data on seasonal distribution (as in 1921-1922 "Program")

B - Flight (Adults).

1 - Distance of flight.

Note: Sufficient practical data secured relative to flight capability of adults on land (5 miles) and over water (20 miles). Also as to flight altitude, nature of flight, influence of weather upon flight; influence of wind direction upon flight etc; as detailed in 1921-1922 "Program". It is desired, however, to obtain the following additional information if possible.

a - Definite evidence of the flight of adults across Lake Erie from the Canadian to the American side; Mr. Bartley.

(1) - Erect tanglefoot screen near lighthouse on Point Gratiot-operated only when winds are blowing in-shore from the direction of the Canadian side during flight period.

(2) - Use of air-plane patrol in line of flight, bearing "tanglefoot" surface.

(3) - Use of small balloons, bearing "tanglefoot" surface.

(4) - Use of motor-boat patrol in line of flight, bearing "tanglefoot" surface.

C - Relation of artificial and common carrier to dispersion.

1 - Observation to determine if larvae or adults will crawl or alight upon trains or other vehicles.

2 - Distance capable of being carried.

D - Relation of water drift to dispersion of host plants or other material.

1 - Data on tide, ocean and harbor currents off the coast of eastern North America between New York Bay and the Gulf of Newfoundland, with special attention to those in Mass. Bay and off the Mass. coast.

a - Correlate with distance and situation of coastwise infestation.

b - Determine by shore scouting, the possible dispersion through drift carried by these currents.

2 - Data on currents in Lake Erie.

a - Correlate with distance and situation of infestation in N. Y; Penn; Ohio and Mich.

b - Same as 1-b.

c - Place marked cornstalks in Lake Erie on the Canadian side in vicinity of Port Stanley, Ont. Follow by thorough scouting on the

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beach on the American side for possible recoveries.

3 - Field observations.

a - Scouting banks of rivers, lakes, ponds, ocean beaches, and islands for infested host plants or other material cast up by the water.

(1) - Determine whether any stages of P. nubilalis found in such material is living or dead.

4 - Determine possibility of wide dispersion of P. nubilalis by drift of infested material when headwaters of large rivers are located in badly infested areas.

E - Percentage of infestation.

Assignment: Messrs. Patch, Hodgson, and assistants.

Object: To ascertain the increase or decrease of the insect in the same areas from year to year, using corn as a basis.

1 - Field Counts: (Associated with V-J-1).

a - Ascertain the average per cent of infestation in 10 representative fields of each town selected (about 40 towns to date). Examine a definite and uniform number of plants situated in representative parts of each field. Attempt to make these counts in the same fields or farms from year to year and as far as possible on the same variety and type of corn. Include the following data on the regulation field count blank:

- (1) - Town
- (2) - Type and variety of corn.
- (3) - Name and address of grower.
- (4) - Condition of corn.
- (5) - Number of plants examined- Date.
- (6) - Per cent plants infested.
- (7) - Average borers per infested plant.
- (8) - Maximum " " " "
- (9) - Number of ears examined. Date.
- (10) - Per cent of ears infested.
- (11) - Kernels injured or destroyed.
 - (a) - Number on butt side or tip.
 - (b) - Per cent " " " "
- (12) - Per cent of ear stems broken over.
- (13) - Approximate per cent of ears on ground.
- (14) - Number stubble examined. Date.
- (15) - Per cent " infested. Height.
- (16) - Average borers per infested stubble.
- (17) - Maximum " " " "

b - Ascertain the percentage of increase or decrease of infestation in areas where clean-up, or other control work has been carried on.

(1) - For this purpose make similar counts with same regulation field count blank as detailed under a- (1) to (17).

c - Incorporate data secured in a and b in a statistical survey of the relative degree of infestation in each town. Compare from year to year.

d - Similar counts to a and b in fields of economic hosts other than corn and also in weed areas. (Detailed under V-J-1).

F - Classification of infested area.

1 - Classification and mapping of infested area into three classes according to the intensity and character of the infestation. The approximate size of area in each class to be indicated. Compare relative size of area in each class and its distribution from year to year.

Note: No definite effort required to secure information for this work. Sufficient data should be available from the general and detailed observations and field counts made throughout the year by laboratory men,

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field scouts and quarantine inspectors.

- a - Class 1 - Area in which corn, weeds, (Red) grasses, flowering plants, and crops other than corn are heavily infested.
- b - Class 2 - Area in which the infestation (Blue) is confined to corn with a small percentage of infestation in susceptible economic plants other than corn, and in weeds.
- c - Class 3 - Area in which the infestation is (Green) confined almost exclusively to corn.

V - HOST PLANTS.

Assignment: Messrs. Hodgson, Vidler and assistants.

A - Determination.

- 1 - Hibernation. 2 - Collection of mature specimens. 3 - Collections of seeds.

Object: - These collections are of host, and likely host plants for use in determining infested material brought in at any time of the year.

B - Lists of infested plants.

- 1 - Alphabetical. 2 - Systematic.
- 3 - Classified: i. e. indicating relative susceptibility, nature of infestation; frequency of occurrence; shelter plants etc.
- 4 - Plants found in other areas.

a - Eastern N. Y. b - Lake Erie section. c - Canada. d - Old World

Note: For total number of species and varieties found containing larvae consult B-1. For families and genera consult B-2.

C - Summary record chart for each of important host plants.

- 1 - Showing generation and life stages found on, or in, each plant. Also whether used for hibernation or aestivation.
- 2 - Giving degree or "index" of infestation as compared with corn determined as an average from the field percentage and comparative infestation counts.

D - Exhibition material.

- 1 - Jars containing each species and important variety and showing typical infestation in each.
- 2 - Reserve material of corn and a few of the other more important host plants for outside requests.
- 3 - Experiments with preservation of natural colors.
- 4 - Photographs showing typical infestations (See XIII-A)

E - Groups of plants for investigation.

- 1 - Economic.
 - a - Field and garden crops (native, southern, western)
 - b - Ornamentals (flowers, foliage plants)
 - c - Fruits of trees, bushes and vines.
 - d - Shrubs, berry canes, vines etc (raspberry, etc)
 - e - Greenhouse (flowers, vegetables, fruits)

(See also "Outline For Greenhouse Investigation" V-N-1 to 17).

F - Seasonal abundance of insect in each of the more important host plants.

- 1 - Due to generation of insect.
 - a - A comparison of 1st and 2nd generation infestation in more important hosts.
- 2 - Due to condition of plant.
 - a - Normal condition of host plant (i. e. leaf and stalk development; condition of fruit or seed; dry or green etc;) at egg laying, larval feeding, and migrating periods for both generations.

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- b - Durability of plant for protection.
(Associated with F-3 and H-1 to 3).
- 3 - Due to abandonment for new food supply.
- G - Plants used as food by larva.
 - 1 - Plants upon which eggs have been found.
 - a - With subsequent feeding.
 - b - Without.
 - 2 - Parts of plant attacked as related to seasonal growth of plant and seasonal development of insect. (Associated with F-1- and 2).
 - 3 - Duration, extent, nature and appearance of infestation.
 - 4 - Proportion of plants attacked in heavy, medium and lightly, infested areas.

Note: This runs into "Dispersion" and an agreement should be made with this section to avoid duplication.

- 5 - Relation of certain host plants to vitality and future development of insect.

- a - Directly. b - Over several generations.

- H - Plants used as shelter for larva.
 - 1 - Used for hibernation or aestivation.
 - 2 - For food and " " "
 - 3 - Only for " " "
- I - Artificial carriers (egg, larva or pupa)
 - 1 - As food (vegetables, greens, tubers, fruits, grain, forage etc)
 - 2 - Decoration (cut flowers, plants, everlastings etc.)
 - 3 - Propagation (shrubs, berry bushes, vines, bulbs, perennials, roots, cuttings etc.)
 - 4 - Manufacture (Broom corn, hemp, medicinal herbs etc.)
 - 5 - Packing and bedding (hay, straw, weeds, etc.)
 - 6 - Waste (garbage, manure containing litter etc.)

Note: Observations under I to be considered as coming under "Food Plants" only before the plant or plant product enters commerce. After that it pertains to "Dispersion".

- J - Percentage of infestation.

- 1 - Plant or stalk.

Note: This division with the host plant corn is being used chiefly for dispersion records (IV-E-1)

- 2 - Flowers or fruit.
 - 3 - Larvae per plant (average and maximum).

- K - Comparative infestation.

- 1 - Between species (field obs; exp. plots and cages)
 - a - Per cent of infestation.
 - b - Average number larvae per plant.

Note: Be sure and cross reference to "Dispersion"-Field Counts"

- 2 - Between varieties (chiefly at exp. plots with corn)

- a - Same as K-1-a

- b - " " K-1-b

- 3 - Between parts of plant.

Note: This work applies chiefly to corn and in a lesser degree to beets, beans, tomatoes etc.

- 4 - Proximity to corn as affecting degree of infestation.

- a - Economic crops at varying distances.

- b - Weeds in corn " " "

- 5 - Relation between time of planting and harvest with degree of infestation. (See "Plan of Exp. Plot" XIV-A-1-a)

- a - A series of sweet corn plots (and possibly other economic hosts) planted at regular intervals during the season and the respective

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infestations compared.

b - Similar observations on several commercial plantings which are made throughout the planting season on the same farm.

c - Phenological notes on development of certain trees and shrubs in order to compare the advancement of the season with optimum planting date. Very Important

L - Effect of infestation on host plant.

1 - Effect on yields due to plant (stalk) injury.

a - Observations on commercial plantings.

b - Experimental (Attempt to keep a block of plants in a badly infested plot free from infestation for comparative purposes- XIV-A-1-a)

Note: The relative number of ears and nubbins as well as the number and condition of ears should be considered.

2 - Effect on viability of seed.

a - Experiment in planting seed from well formed ears taken from badly infested plants as compared with ears from non-infested plants selected from the same lot or field.

M - Economic losses (See "Statistics" XII-A-1- to 3)

N - Greenhouse investigations - Mr. Powers and assistants.

1 - Chrysanthemums.

a - Find out what percentage of 'mums are grown out doors during the summer and then transplanted to greenhouse in the fall.

(1) - About what date are they brought inside?

b - What percentage of 'mums are grown inside greenhouse all summer?

c - What becomes of the remainder of the plant (stalks and root) after blooms are picked in the fall? Are remains of stalks left on roots?

(1) - If last season's roots, with remainder of stalks, are stored inside, examine stalks for possible presence of corn-borer.

(2) - Can these old roots and stalks be a source of infestation in the greenhouse next season?

d - How are new plants secured and grown for next season? Mention dates.

(1) - Are they liable to be shipped outside quarantined area?

e - How extensive is the practice of potting young 'mum plants for sale?

(1) - Are such plants generally shipped any distance, and what proportion of potted plants are shipped?

(2) - Find out the source from which most of these plants come that are used for potting.

(3) - Any chance of them carrying infestation when shipped?

f - How extensive is the practice of selling potted 'mums in bloom?

g - Is there any practical objection to screening all openings (ventilators, windows etc) from early in the spring (May 15) to late in the fall (Nov. 15), when plants are to be grown in the houses all during the season?

Note: Cheese-cloth was used successfully to screen one greenhouse during 1921.

h - Is it necessary to bring stable manure, or compost, containing portions of corn stalks or large weeds into the greenhouse at any time?

i - Loss as a result of corn-borer damage during 1921 (not as a result of quarantine).

(1) - Approx. total number of plants grown.

(2) - " " destroyed or discarded owing to corn borer damage.

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2 - Asters.

a - What is the general method of propagating and growing asters in greenhouses? Mention dates.

(1) - Is there much variation in the methods practiced by different growers?

b - What percentage of asters grown inside are sold as potted plants? Mention dates.

(1) - Is the volume of this business very large?

c - What percentage of asters grown inside are sold as cut flowers? Mention dates.

(1) - Same as b-(1).

d - Same as 1-h.

e - Temperatures used, if any heat is applied.

3 - Dahlias.

a - Get additional information about possible shipment of dahlia bulbs containing portions of stems.

b - Additional information relative to shipment of potted dahlia plants or dahlia cuttings. (Dates shipped).

4 - Cosmos.

a - Are any of these plants grown in greenhouses (except as small transplants)?

(1) - Find out method of growing and the dates of sale, if any flowers are produced in greenhouses.

(2) - Temperatures used, if any heat is applied.

b - Examine for infestation.

5 - Zinnias.

a - Same as 4-a- (1) and (2).

b - Examine for infestation.

6 - Hollyhocks.

a - Are any plants grown in greenhouses either to be sold as transplants or as flowers?

(1) - If so, find out methods of growing, and dates of sale.

(2) - Temperatures.

(3) - Any chance of the transplants carrying infestation out of area?

b - Examine for infestation.

7 - Jerusalem Cherry.

a - Method of propagation in greenhouses. Mention dates.

b - Are they set out-doors during the summer, and if so, to what extent? Mention dates, especially when set out, and when brought inside.

(1) - Are any of the large plants (bearing cherries) shipped directly after being brought inside? If so, to any great distance?

c - At what time of year are most of these plants sold? Always as potted plants?

d - Temperatures used when growing in greenhouse?

e - How extensively are these plants grown?

8 - Roses.

a - Examine growing plants in greenhouses located in badly infested districts.

(1) - One instance of infestation in roses during 1921.

(2) - Report of infestation in greenhouse in Revere.

9 - Geraniums.

a - Examine old plants growing in greenhouses.

b - In the early spring (April or May) examine young potted plants

c - How extensive is the practice of potting plants for sale?

Get information on methods of making these slips-with dates.

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d - Temperatures used.

10 - Gladiolus.

a - Are gladiolus grown in greenhouses in this area?

b - If so, find out method of growing them-with dates.

c - When are flowers sold? Mostly in funeral pieces or as cut flowers?

d - Temperatures used.

e - Examine for infestation.

11 - Callendula (Scotch Marigold)

Same as J - 10-a to e.

12 - Marguerites.

Same as J - 10-a to e.

13 - Feverfew.

Same as J - 10-a to e.

14 - Heliotrope.

Same as J - 10-a to e.

15 - If a bad infestation was present in any of the houses during the fall of 1921, or at the present time, find out if possible what was done with the infested material.

a - Was all of this infested material taken out of greenhouse when cleaning up?

b - Any chance for the borers to leave the infested plants and enter other plants in the vicinity?

c - Any chance for the borers to leave the infested plants and bore into wood work, or between spaces in boards, or in rubbish?

16 - Beets.

a - In the early spring, beets are sometimes grown in greenhouses under cucumbers and among other plants. Spend some time, if possible, in examining these plantings, especially when the greenhouses are located in intensely infested areas.

b - Temperatures used.

c - Date when most of this crop is shipped.

17 - Rhubarb.

a - Line up places where rhubarb is grown inside for late winter or very early spring sale.

(1) - F. L. Young of Methuen has a business of this kind, and ships considerable stuff.

b - Examine such rhubarb for infestation - especially when grown in intensely infested areas.

c - Date when most of this crop is shipped.

d - What temperatures used in these houses?

GENERAL NOTE We are trying to obtain evidence as to whether a third generation is possible in greenhouses. No evidence of a third generation inside has yet been discovered, but it seems perfectly possible, as we are able to rear several successive generations of the insect in incubators during the winter at a temperature around 60° Fahr.

VI - HISTOLOGY.

Assignment:- Mr. W. O. Ellis.

A - To ascertain whether there is any structural reason why overwintering P. nubilalis larvae do not resume feeding in the spring on new growth, prior to pupation. If structural differences exist between the following stages.

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- 1 - Normal larvae in a feeding condition.
- 2 - Larvae from field in November.
- 3 - " " " " May.
- 4 - Pre-pupae.
 - a - What are these differences?
 - b - " organs are affected?
 - c - Character of anatomical differences brought about.
 - (1) - By dissolution. (2) - By modification.
 - (3) - " intestinal obstruction.

B - Pupae - Study of the progressive structural changes taking place within the pupa.

- 1 - By fixing, sectioning, staining and mounting specimens at 12 hour intervals for period of 7 days - using incubating pupae.

C - Adults - male and female.

- 1 - Brief study of sections of male and female moths with special stress on the regenerative systems.

D - Eggs.

- 1 - Structure of eggs when freshly oviposited.
- 2 - Study of embryonic advances every 12 hours or at more frequent intervals during incubation.

VII - PARASITES.

Assignment: - Messrs. Jones, R. C. Ellis, Garmon and assistants.

A - Parasites - Native.

Note: All work under native parasites reduced to an absolute minimum because 1921 results were very exhaustively done and actual percentage of parasitism was negligible (except the sporadic egg parasite). Therefore, the breeding and liberation of foreign parasites will be stressed.

- 1 - Larval and pupal parasites of second 1922-23 generation. Full collection.

- 2 - Egg parasites - 1st and 2nd generation.

- 3 - Larval " " " " "

- 4 - Pupal " 2nd " 1st "

B - Parasites - Foreign.

- 1 - Egg parasites. (if secured)

- 2 - Larval "

- a - Habrobracon brevicornis.

- (1) - Recovery and dispersion records on the adults bred and liberated in 1922.

- (2) - Breeding sufficient stock to meet any requests from other entomological agencies - or for any emergency purposes. No large rearing campaign considered necessary.

- b - Exeristes roborator (rec'd Oct. 1922)

- (1) - Further improvement of rearing methods.

- (2) - Campaign for record production rearing and field liberation in 1923.

- (a) - Attempt to liberate 50,000 in 1923 (10,000 was Hyeres prediction).

- (b) - Liberations to be made in three "waves" to correlate with host abundance.

- c - Diocetes sp. (not expected before March 1923)

- (1) - Develop methods of rearing host larvae to life stage of parasitism (2nd instar).

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(2) - Develop methods of rearing parasitized larvae for least mortality.

(3) - Develop simple, efficient equipment and systematic handling so that Hyeres laboratory technique can be made to give record production.

VIII - PREDATORS AND ASSOCIATED INSECTS.

Assignment: - Mr. Barber and laboratory staff.

A - Predators.

1 - Of the egg.

a - Insects.

(1) - Coccinellidae. (2) - Chrysopidae.

2 - Of the larva.

a - Birds.

(1) - Barnyard fowl. (2) - Other birds.

b - Insects.

(1) - Pentatomidae. (2) - Reduviidae.

(3) - Carabidae. (4) - Hymenoptera etc.

c - Animals.

(1) - Mice.

3 - Of the pupa.

a - Birds. b - Insects. c - Animals.

4 - Of the adults.

a - Birds.

B - Associated insects.

1 - Occuring in larval burrows in corn.

a - Diptera. b - Coleoptera.

2 - Occuring in larval burrows in host plants other than corn.

IX - DISEASE.

Assignment - Laboratory staff.

A - Superficial observations concerning death of larvae in field from disease.

1 - Frequent occurrence in rearing cages.

X - Laboratory METHODS AND TECHNIQUE.

Assignment: - Mr. Barber and assistants.

Object: Investigation and development of methods, cages and special apparatus for rearing of material and carrying on special investigations.

A - Cages for eggs, larvae, pupae and adults.

B - Incubators.

C - Laboratory cages containing growing food plant and arranged in such a manner that development of insect may be observed without frequent change or radical disturbance of food plant.

D - Laboratory cages designed to contain portions of plant upon, or in, which the insect may develop with only infrequent disturbance of food plant.

E - Large field cages designed to contain growing plants, which can develop in a normal manner, and in which one or more generations of P. nubilalis may be reared without disturbance and retain their vitality. These cages must retain all stages of P. nubilalis, liberated therein and exclude all stages of the insect from without.

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XI - TAXONOMY.

Assignment: - Messrs. W. O. Ellis and Sanderson.

- A - Preparation and preservation of adult material.
 - 1 - Reared. 2 - Collected.
- B - Preservation of larval material.
 - 1 - Larvae, known, reared or collected in bulk.
 - 2 - " sent in by field scouts and quarantine inspectors.
- C - Arrangement and care of collection.
- D - Preparation of material for exhibition or study.
 - 1 - Large number of eggs, larvae, pupae, and adults kept on hand to fill requests for exhibition material or study material.
 - 2 - Riker mounts. 3 - Exhibit cases.

XII - STATISTICS.

Assignment: - Laboratory staff.

- A - Crop losses.
 - 1 - Corn.
 - a - Sweet.
 - (1) - Losses due to unmarketable products (ears, grain etc)
 - (2) - " " " restriction of market area (quarantine).
 - (3) - " " " reduced price through reduction in quality.
 - (4) - Losses due to control measures.
 - (a) - Cleaning-up, burning etc.
 - (5) - Losses due to reduced acreage, because of presence of insect.
 - b - Field (flint or dent). c - Pop. d - Fodder.
 - 2 - Celery, beans, beets, rhubarb etc.
 - a - Same as 1-a (1) to (5).
 - 3 - Chrysanthemums, asters, gladiolus etc.
 - a - Same as 1-a (1) to (5).
- B - Corn acreages and value of crops.
- C - Weather reports.
- D - Maps.

XIII. - PHOTOGRAPHY

Assignment: - Mr. Hodgson.

- A - Photographs of: -
 - 1 - Apparatus (cages, incubators, traps etc).
 - 2 - Experimental equipment and observational material.
 - 3 - Drawings, maps, charts, signs etc.
 - 4 - Infested host plants, and portions thereof showing typical injury and life stages in situ.
 - 5 - Parasites and their manipulation.
 - 6 - Related insects and their work.

Note: These photos are necessary for exhibits; lectures; illustrating publications; filing with notes; explanation of experiments and apparatus; identification of plants etc. The more important ones may be enlarged or reproduced as lantern slides.

XIV - PLAN OF EXPERIMENTAL PLOTS

Assignment: - Messrs. Hodgson, Vidler, Greene and assistants.

- A - Grove St. Plot - West Medford, Mass.
 - 1 - Plots of various host plants for special observations and demonstration purposes.
 - a - Corn

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(1) - Flint field corn (Large plot)

(a) - If weather and soil conditions permit, attempt to plant one half of this plot about 10 days before the usual planting period for field corn; in an attempt to mature the ears before the larvae of the second generation become large enough to cause serious injury.

(b) - Attempt to keep a small block of plants in approximately center of this plot free of infestation by hand picking eggs and larvae; and by use of barriers to prevent migration. For purpose of comparing ear and grain formation etc with surrounding, heavily infested plants - (also referred to in V-L-1-b).

(2) - Dent field corn (Large plot)

(3) - Pop corn (Small plot)

(4) - Sweet corn.

(a) - Golden Bantam - 5 plantings.

(b) - Black Mexican - 3 "

(c) - Early Cory - 2 "

Note: (a), (b) and (c) a continuation of the project to determine optimum planting date. Also correlated with harvest date (period required for maturity) and varietal differences in rate of growth from seeding to "roasting ear" stage.

(d) - Attempt to segregate a small block of plants in one of the late plantings in same manner, and for same purpose, as (1)-(b)

b - Field crops. (Small plots of each)

(1) - Hegari. (2) - Sudan Grass.

(3) - Millet.

(a) - Japanese. (b) - Hungarian.

(c) - European.

Note: Stress the possibility of using millet especially European millet as a trap crop to be planted as soon as soil can be worked.

(4) - Oats (Large plot planted late in area vacated by early sweet corn).

(5) - Alfalfa. Very Important

c - Vegetables (Small plots of each.)

(1) - Tomato. (2) - Peppers.

(3) - Celery. (early and late)

(4) - Beans. (3 plantings compared)

(5) - Beets (do)

(6) - Rhubarb. (7) - Asparagus.

d - Flowers. (Small plots of each)

(1) - China Aster (2) - Straw Flower. (3) - Zinnia.

(4) - Marigold. (5) - Gladiolus. (6) - Geranium.

(7) - Dahlia.

2 - Area reserved for large field cages.

3 - " " " insecticide experiments.

B - Alewife Brook Plot-Arlington, Mass. (or similar location).

1 - An acre or more planted exclusively to early maturing dent field corn.

C - - - - - (site to be selected).

1 - An acre or more planted exclusively to typical northern grown flint field corn.

(Stamp of Local Board)	Serial No.	Name of Registrant: Telephone No. _____		Name							
	Order No.	(First name.) (Middle name.) (Last name.)									
(Designation of District Board)		Address _____ (No.) (Street or R. F. D. number.)									
		(City or town.) (County.) (State.)									
		UNDER JURISDICTION OF LOCAL BOARD UNDER JURISDICTION OF DISTRICT BOARD									
		(Enter letters showing divisions claimed or found in squares showing class claimed or found.)									
Classification claimed by registrant	I	II	III	IV	V	I	II	III	IV	V	
Classification claimed by another person	I	II	III	IV	V	I	II	III	IV	V	
Classification by Local or District Board	I	II	III	IV	V	I	II	III	IV	V	
Vote of board on most deferred classification found	Ayes _____ Noes _____					Ayes _____ Noes _____					
	I	II	III	IV	V	I	II	III	IV	V	
Classification on appeal											

- | | | |
|---|--|---|
| 1. Questionnaire mailed _____
4. Classification posted _____
7. Record forwarded to President _____
10. Report of medical advisory board _____ | 2. Questionnaire returned _____
5. Record forwarded to District Board _____
8. Ordered to report for physical examination _____
11. Action of Local Board on physical examination _____ | 3. Time extended to _____
6. Record returned by District Board and reclassification posted _____
9. Report of examining physician _____ |
|---|--|---|
-
- | | | |
|---|---|--|
| 13. Action of District Board on appeal _____
16. Reported for entrainment _____
19. Reported to adjutant general of State as delinquent _____
22. Date received at mobilization camp _____ | 14. Physical examination record returned by District Board _____
17. Date of entrainment _____
20. Reported to Adjutant General of Army as deserter _____
23. Transferred to Local Board for _____ | 12. Physical examination forwarded to District Board on appeal _____
15. Date ordered to report for entrainment _____
21. Date of apprehension _____
18. Rejected } at mobilization camp.
Discharged } |
|---|---|--|

RECLASSIFICATION

Date	By whom reclassified	I	II	III	IV	V	Vote of Board		Signature of official
							Ayes	Noes	

